3. ALTERNATIVE ALIGNMENTS

The Grand Junction corridor has been extensively studied, with a number of existing and proposed uses of the corridor. This chapter examines two primary alignment alternatives for a Grand Junction corridor trail.

The alignment alternatives analyzed in this section include:

- Option 1: Rail-with-Trail (RWT) only, using the full available ROW outside of the rail operations. This will be referred to as the *RWT Option*.

- Option 2: RWT and Bus Rapid Transit (BRT) one-way. Requires track relocation for the Charles River to Main St. segment of the trail. This will be referred to as the *RWT/BRT Option*.

Under each segment, the alignment options are discussed. Text and photos depicting significant issues, such as property ownership, intersections, and utility needs, are also shown. Detailed layout of the corridor is shown in the Appendix C. Note that Option 2 is the same as Option 1 from Main Street to Gore Street.

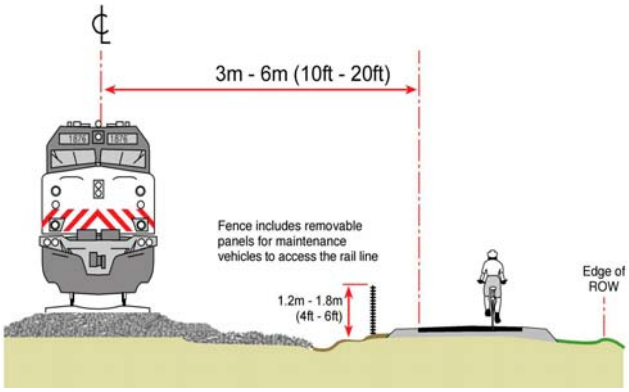
Two additional alignments were evaluated based on Urban Ring options that are no longer under consideration. One alignment was a light rail transit (LRT) facility in the corridor. In this alignment, the Grand Junction Trail was placed to the north of a shared railroad/LRT corridor. The second optional alignment for the Urban Ring included a two-way bus rapid transit (BRT). The analyses for these options are available through the City of Cambridge Community Development Department.

A third, "No build" option, using surface bikeways and sidewalks is described and discussed at the end of this chapter.

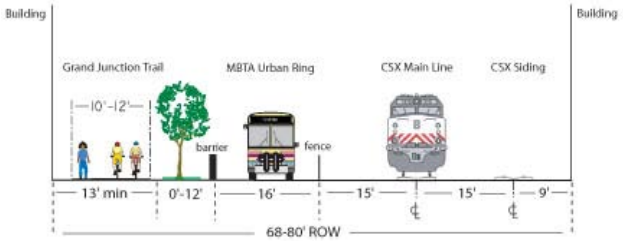
The Grand Junction Trail would accommodate a wide range of users including pedestrians, persons in wheelchairs and bicyclists of varied abilities. The path would accommodate family cycling. Assumptions regarding trail design include:

- Typical path width 12 feet
- Width of path shoulders 2 to 3 feet
- Typical setback from edge of trail to railroad centerline 20 feet, may be narrowed to 10 feet in restricted locations
- Trail setback from buildings 3 feet or greater
- Fence typically installed between path and railroad

More detail on the proposed trail design is provided in Chapter 4.



Typical Cross Section: Option 1



Typical Cross Section: Option 2

For the sake of the following descriptions of land use, ownerships, existing conditions, constraints and opportunities, the Grand Junction corridor through Cambridge is segmented as follows:

- **Section 1: Charles River to Ft. Washington Park**
- **Section 2: Ft. Washington Park to Massachusetts Avenue**
- **Section 3: Massachusetts Avenue to Main Street**
- **Section 4: Main Street to Binney Street**
- **Section 5: Binney Street to Cambridge Street**
- **Section 6: Cambridge Street to Gore Street**

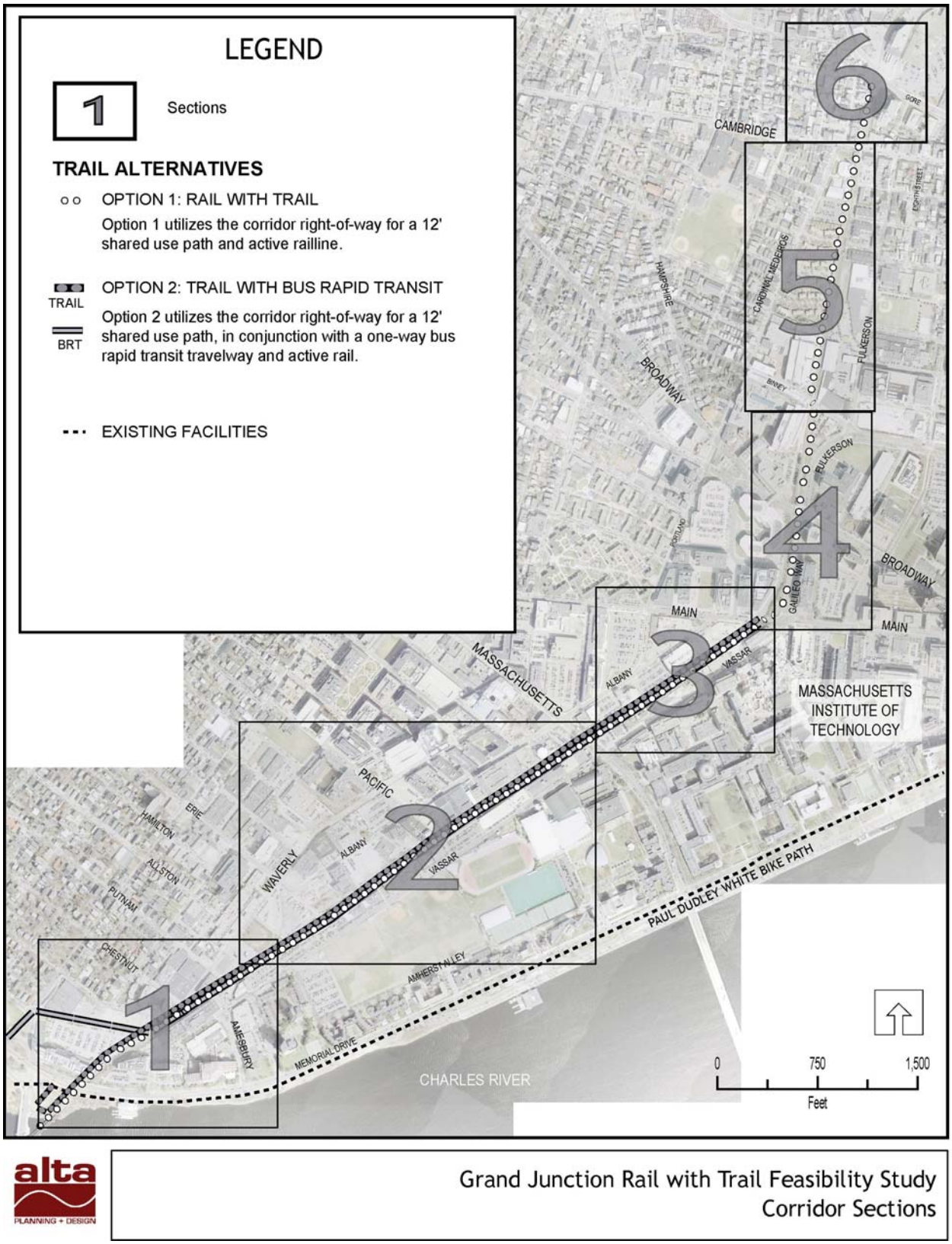
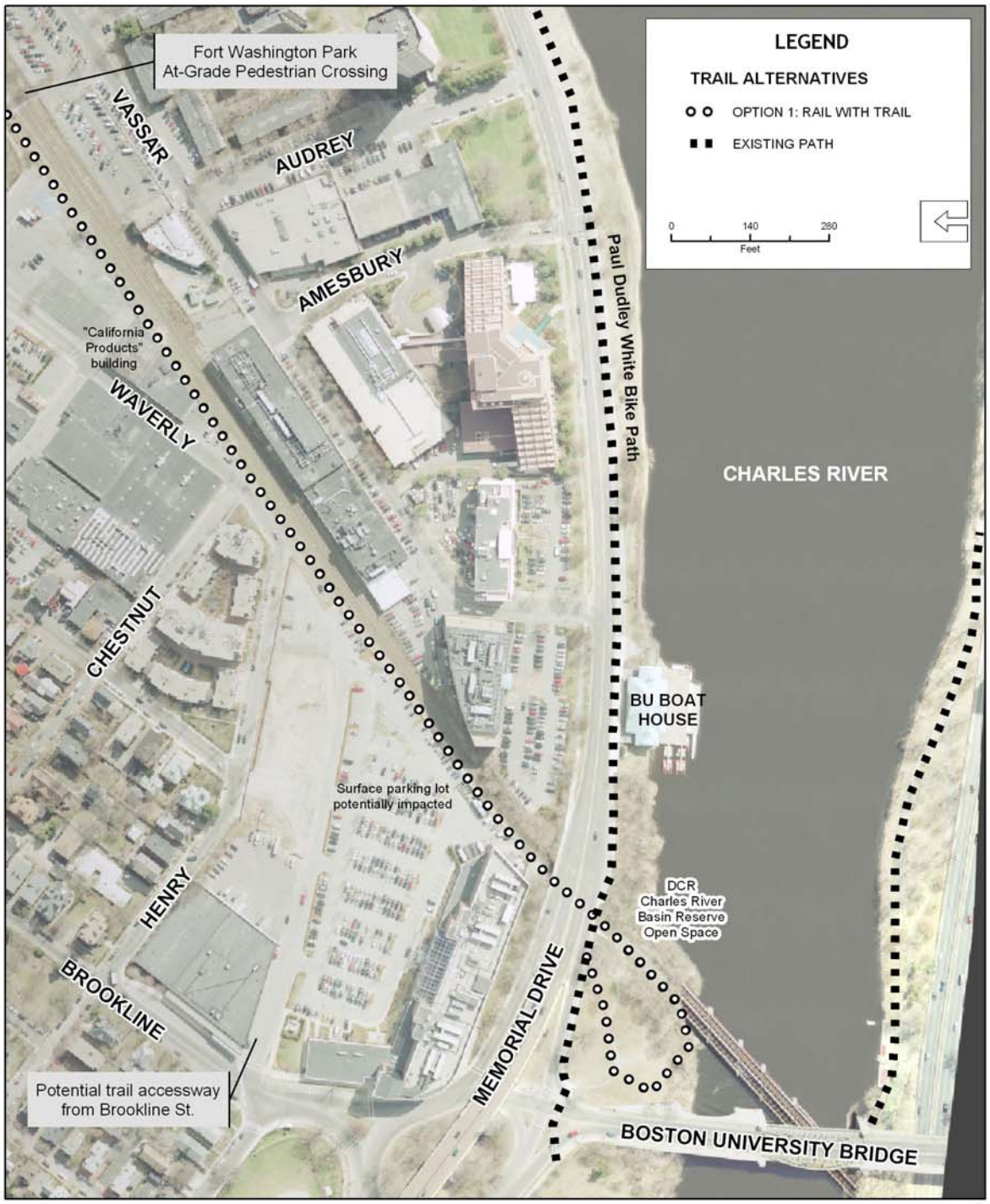
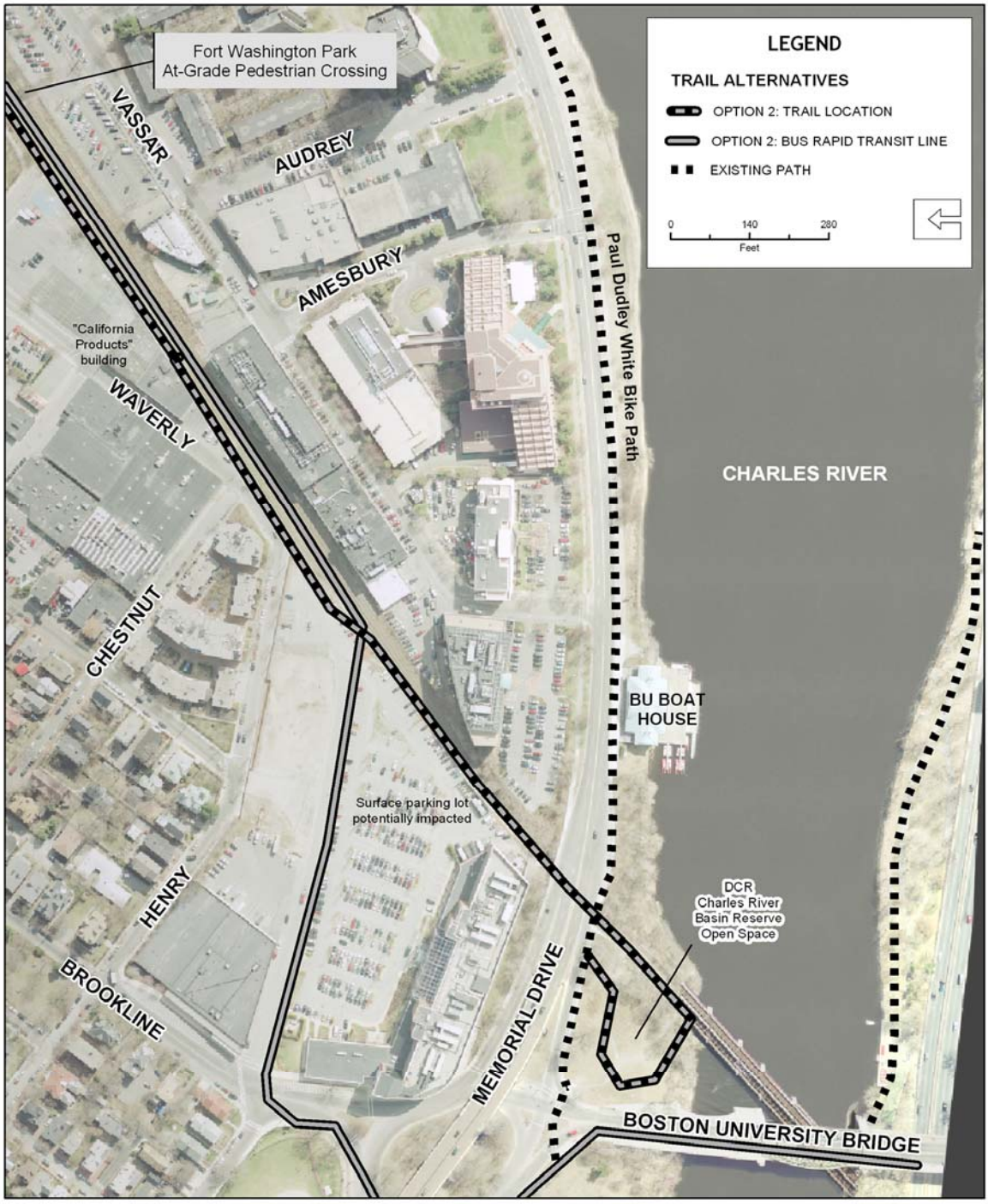


Figure 3-1. Grand Junction RWT Alignment Alternatives

Section 1: Charles River to Ft. Washington Park (RWT)



Section 1: Charles River to Ft. Washington Park (RWT/BRT)



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Option 2: Trail with Bus Rapid Transit
Section 1: Charles River to Ft. Washington Park

Section 1: Charles River to Ft. Washington Park

EXISTING CONDITIONS SUMMARY

The railroad bridge over the Charles River Basin is a 6-span, triple through-girder structure, originally built to carry two tracks. As seen in the top picture to the right, it passes diagonally under the Boston University (BU) Bridge (single span, steel arch) while it crosses the river. The bridge connects Boston in the midst of the BU campus with the Cambridgeport section of Cambridge.

Memorial Drive passes over the rail right-of-way on a single-span structure. Only one track passes under this overpass. However, the structure's span was set to accommodate two tracks. The distance between the abutments is shown in the second picture. The additional room under the bridge presents an opportunity for a possible path. The single track at Memorial Drive branches out to four tracks immediately north of the overpass. One long siding (east of the main track) extends to Massachusetts Avenue. West of the main track are the old Necco spur and a short siding. The Necco spur is out of use and is being removed.

The right-of-way is bounded by fencing and the rear of buildings. Fencing is typically chain link, 6 to 8 feet tall. The right-of-way is unfenced along Waverly Street between Chestnut and Henry Streets.

This section passes through former industrial land, with some residential uses and MIT facilities.

In the third picture, the four tracks are (right to left): the long siding, the main track, the Necco spur, and the siding. The physical right-of-way is entirely occupied by railroad infrastructure in this stretch.

OWNERSHIP

Open space - DCR Charles River Basin Reservation

Rail corridor right-of-way – CSX railroad and MIT

UTILITIES

For segments 1 & 2 (Memorial Drive to Pacific Street Extension)

The existing utility information available for this section of the pathway is limited. Information was obtained from GIS files obtained through the City of Cambridge DPW, some survey information obtained from the MIT Vassar Street Project and limited record maps from various utility companies.

There does not appear to be a substantial amount of utilities along the proposed pathway route within this section. A utility crossing is perpendicular to the railroad tracks and proposed pathway at Chestnut Street. The utilities confirmed to cross at this location are a 12-inch water main, a 6-inch gas main, a 12-inch sanitary sewer line and a 28-inch by 32-inch storm drain. It is unlikely that the utilities in this location will produce any conflicts with the construction of the pathway.

Looking southeast across the Charles River

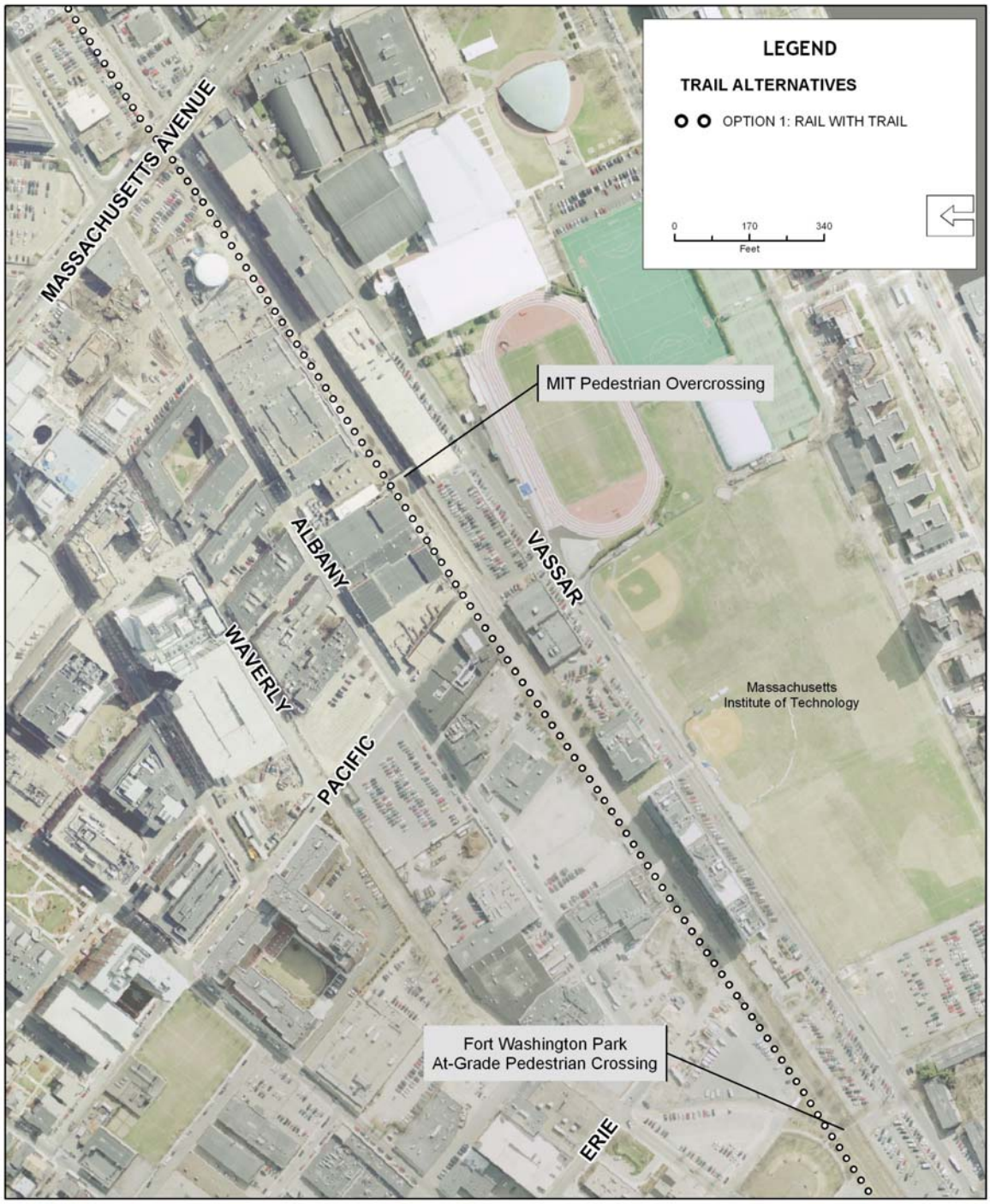
Memorial Drive Overpass: available room

Four tracks near Waverly Street and California Products

Section 1: Charles River to Ft. Washington Park

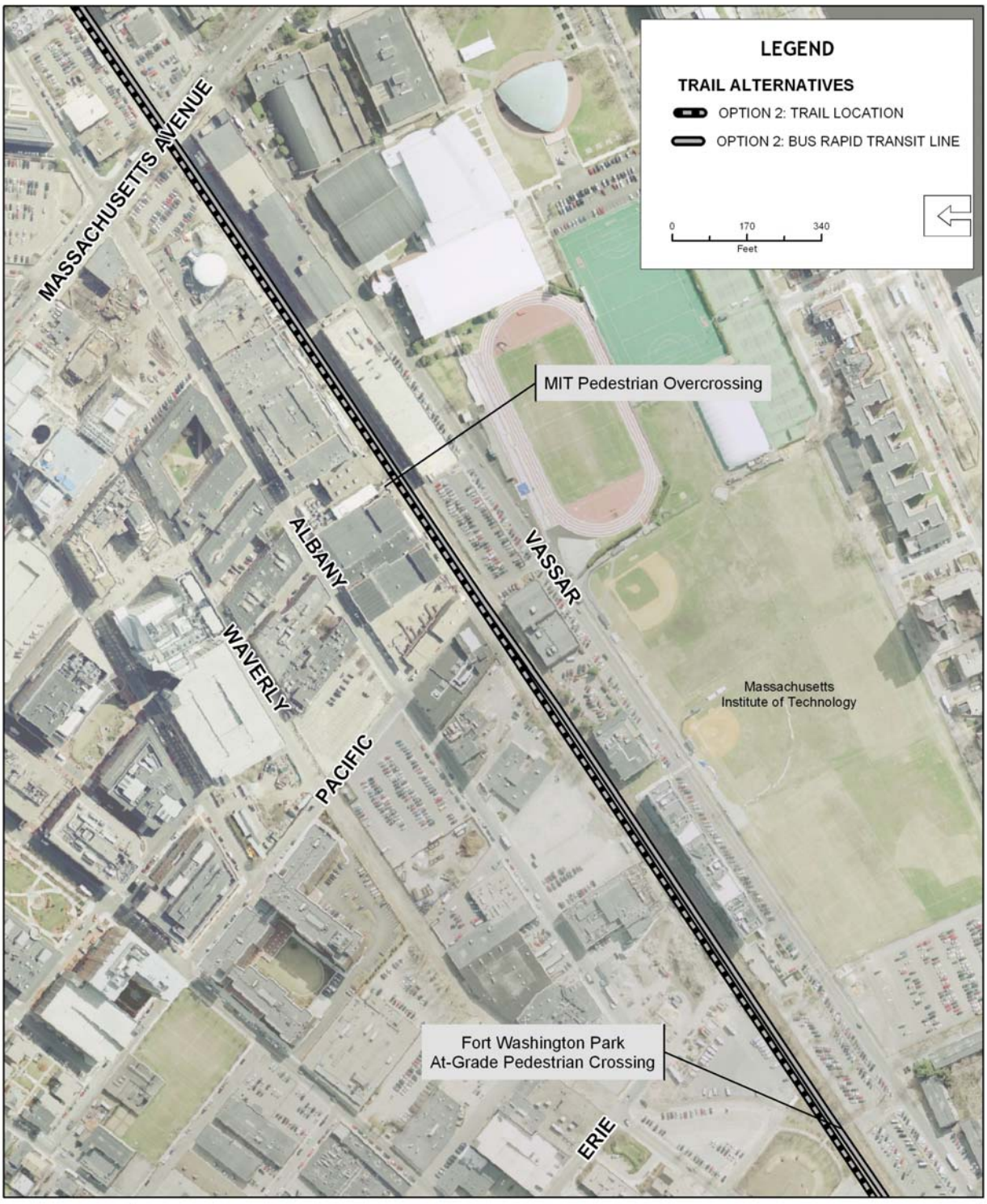
OPTION 1: RWT	OPTION 2: RWT/BRT
Description	Description
Connecting the Paul Dudley White Path with the Grand Junction trail is critical. For Option 1, the recommended connection is through the DCR Open Space to connect with the railroad undercrossing of Memorial Drive. In the section between the Charles River to just past Memorial Drive, a fence or protective barrier could be placed between the railroad track and the shared use path. Just north of the Memorial Drive bridge over the railroad, the shared use path would taper outward away from the railroad. Heading further north, the shared use path would occupy area now covered by siding that once served the California Products building. The path would remain on the west side of the Grand Junction Railroad (main line) to the vicinity of Main Street.	Connecting the Paul Dudley White Path with the Grand Junction trail is critical. The preferred connection would follow Option 1, with the path located on the west side of the corridor, with BRT in the middle and the rail to the east.
Setback Distance	Setback Distance
Charles River to Memorial Drive: 10 feet from railroad centerline. Memorial Drive to Ft. Washington Park: 20 feet from railroad centerline.	Dependent on the relocation of the CSX siding (and possible main line) in this section. With relocation, the setback would be approximately 30-40 feet from railroad centerline..
Key Issues	Key Issues
The short separation distance between the tracks and the proposed path at the beginning of this section. The short siding would most likely need to be removed to locate the path in this section. MIT owns the old California Products property and the buildings are currently unoccupied. If the site were redeveloped, it would be important to look at a building alignment with a greater setback from the proposed trail alignment. Northeast of Memorial Drive, the path would impact a portion of a surface parking lot and a mechanical unit on MIT property. Topographical constraints. Multi-jurisdictional area requires working with several agencies.	The movement, or removal, of the CSX long siding on the southeast side of the CSX mainline to accommodate both the Grand Junction trail and the Urban Ring. Narrow setback distance of trail from railroad centerline. Potential for necessary improvements to Amesbury Street and the intersection at Memorial Drive Potential for necessary improvements to the connection with the Paul Dudley White Bikepath. Potential conflicts between trail access from Brookline and the BRT line (although latest MTBA plans show this area still under review). Creating a safe at-grade crossing of both the Grand Junction line and the BRT for path users.

Section 2: Ft. Washington Park to Massachusetts Avenue (RWT)



Overcrossing refers to a specific type of pedestrian crossing that is elevated above the grade of the roadway/train tracks etc

Section 2: Ft. Washington Park to Massachusetts Avenue (RWT/BRT)



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Option 2: Trail with Bus Rapid Transit
Section 2: Ft. Washington Park to Massachusetts Avenue

Section 2: Ft. Washington Park to Massachusetts Avenue

EXISTING CONDITIONS SUMMARY

This section of the Grand Junction corridor passes between the Cambridgeport neighborhood and the Massachusetts Institute of Technology (MIT) campus. This is the longest segment without a roadway grade crossing, although there is a pedestrian grade crossing adjacent to Fort Washington park.

The right-of-way is bounded by fencing and the rear of buildings. Fencing is typically chain link, 6 to 8 feet tall.

North of Ft. Washington Park, the physical right-of-way widens. The two tracks are along the east side of the right-of-way. West of the tracks is a wide (approximately 30 to 40 feet) area used as an unpaved access road. At Pacific Street, there is a private right-of-way that connects to Albany Street.

This segment includes a mix of industrial, commercial and institutional lands. However, not all of it is used for educational purposes. There are several buildings used for office as well as research and development. Other buildings are used as office or research and development, such as 270 Albany Street.

MIT facilities abutting the corridor include parking facilities (open lots and one garage on Vassar Street); office, classroom, and laboratory space; and a functioning nuclear power plant on Albany Street, used for research purposes.

The railroad crosses Massachusetts Avenue in close proximity to the Vassar Street and Albany Street intersections. Both intersections are signalized and have concurrent pedestrian phasing. Massachusetts Avenue is the busiest street crossing in the Grand Junction corridor. It has two travel lanes and a parallel parking lane in each direction (a few blocks have on-street parking on the north side only). Bicycle lanes are being added as part of the Massachusetts Avenue reconstruction project.

OWNERSHIP

The right of way is railroad-owned to a point approximately 200 feet south of Pacific Street. North of that point, the right-of-way is owned by MIT with an easement for the railroad

The corridor is owned by MIT with a 32-foot-wide easement granted to CSX. An additional 8-foot easement is granted to CSX for their siding.

UTILITIES

See Segment 1.

Segments 2 & 3: Utility information was obtained from As-Built and Survey Information for the Vassar Street project. Numerous utilities are located within the pathway, most of which are owned and maintained by MIT. These utilities include: MIT Electric, MIT Communications, MIT Chilled Water, MIT Hot Water and MIT Steam.

One or several of these utilities are located beneath the proposed pathway for the entire length from Pacific Street to Main Street. There are more than 40 structures (manhole covers and gate boxes) located within or immediately adjacent to the pathway within this section. Many of the ductbanks in this section have been installed with a minimal amount of cover.

Ft. Washington Park

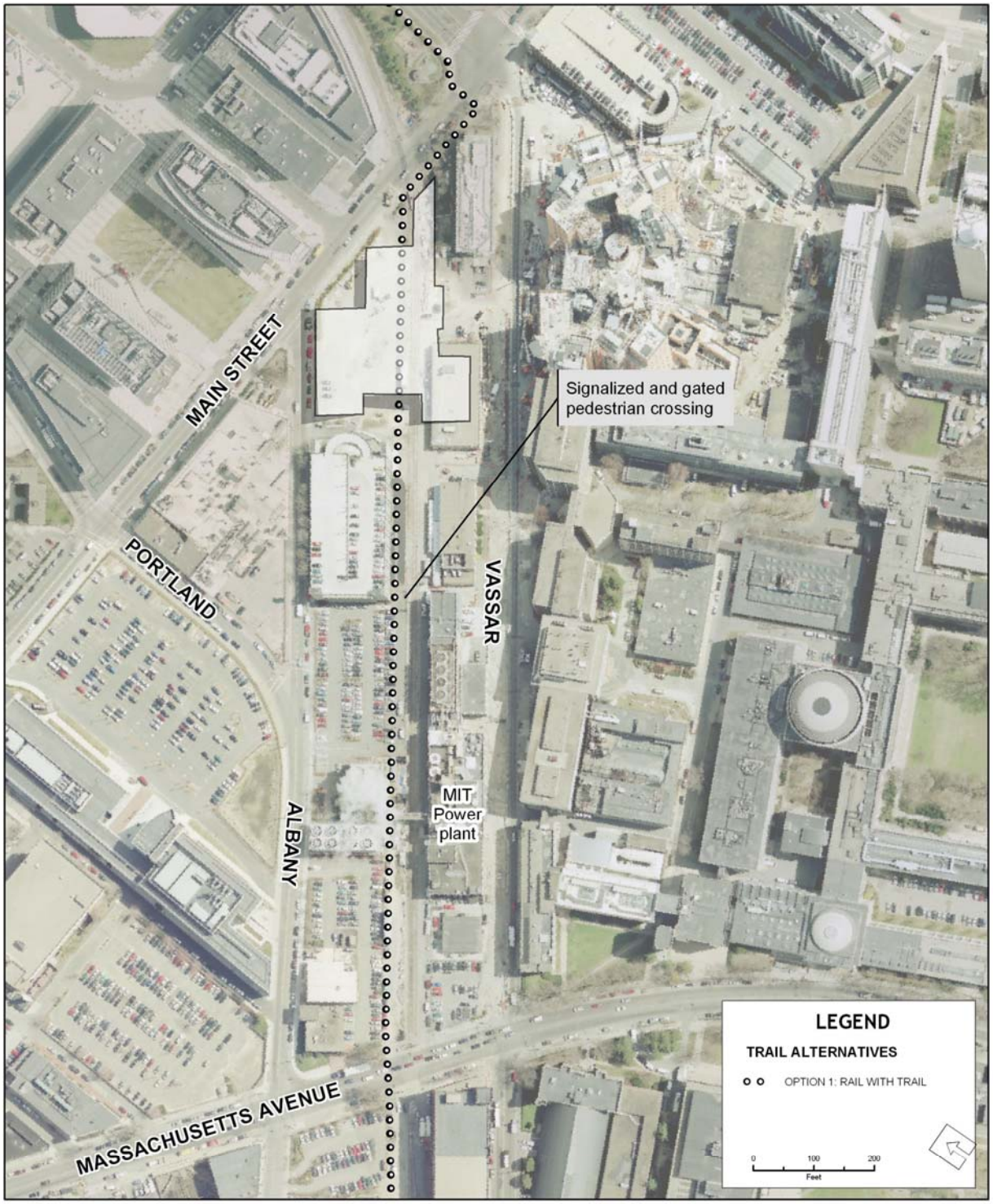
Looking north towards Massachusetts Avenue

Massachusetts Avenue Grade Crossing: Looking north from rail corridor

Section 2: Ft. Washington Park to Massachusetts Avenue

OPTION 1: RWT	**OPTION 2: RWT/BRT**
Description	Description
The path would be located on the west side of the Grand Junction railroad main line for this entire section. The path would be set back from buildings on the west side of the corridor by varying distances. The path would share the use of the service corridor and truck ramp behind several of the MIT buildings.	The path would be located on the west side of the Grand Junction railroad main line this entire section.
Setback Distance	Setback Distance
15 - 20 feet from the edge of the path to the railroad centerline.	Dependent on the relocation of the CSX siding (and possible main line) in this section. With relocation, the setback would be approximately 30-40 feet from the railroad centerline.
Key Issues	Key Issues
Working with MIT as the primary land and rail corridor right of way owner will be a key aspect of the success of the Grand Junction Trail. MIT has important service functions at the rear of the Plasma Fusion Laboratory. Maintenance of the service corridor behind this building is critical to the operation of MIT. MIT also expects an increase in the amount of service activity that will occur in this section of the corridor as more of their buildings come on line. At-grade crossing at Massachusetts Ave.	Working with MIT as the primary land and rail corridor right of way owner will be a key aspect of the success of the Grand Junction Trail. The movement, or removal, of the CSX long-siding on the southeast side of the CSX mainline through this entire section to accommodate both the Grand Junction Trail and the Urban Ring. The narrow separation distance from buildings on the southeast side of the corridor. At-grade crossing at Massachusetts Ave.

Section 3: Massachusetts Avenue to Main Street (RWT)



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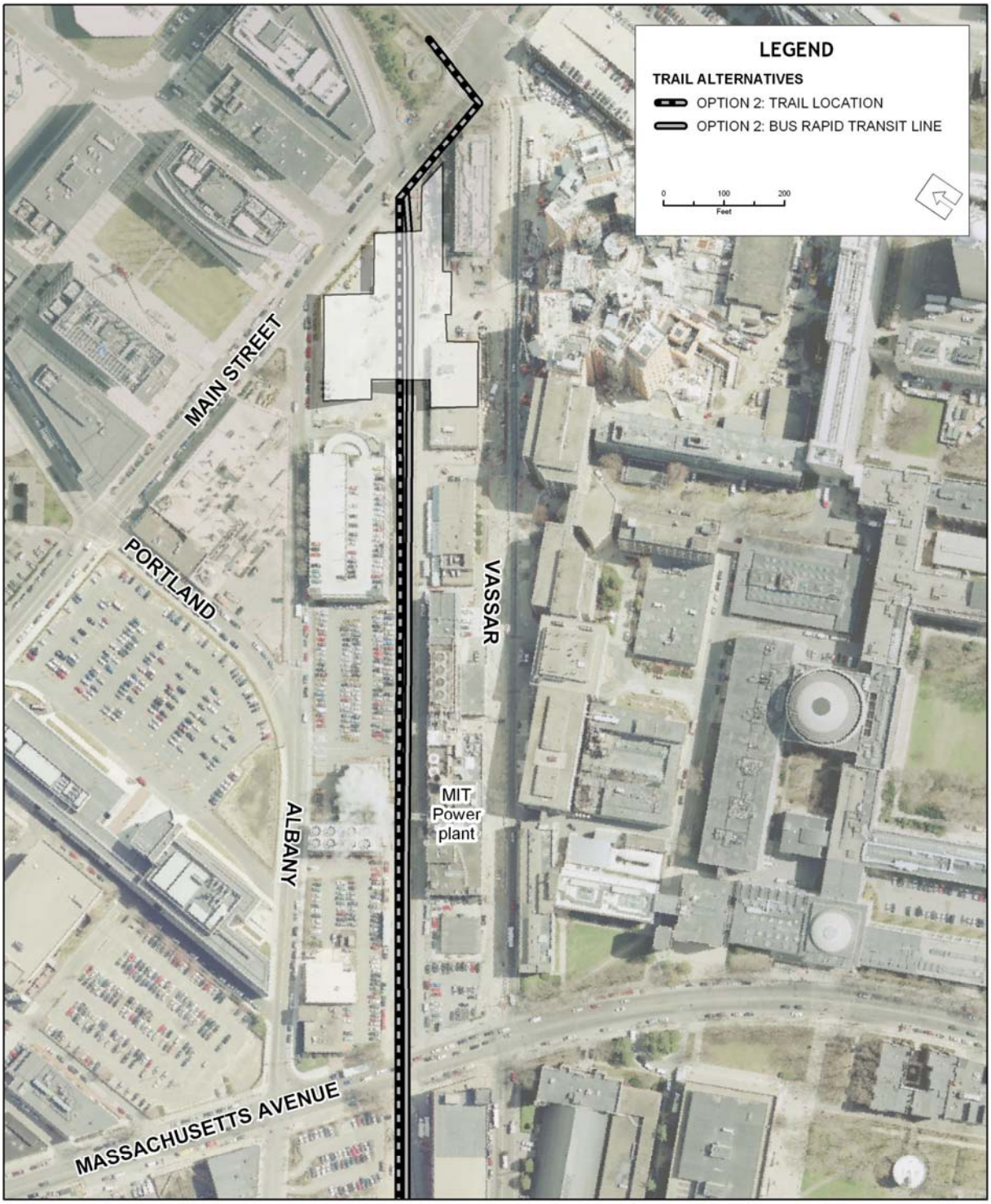
Option 1: Rail with Trail

Section 3: Massachusetts Avenue to Main Street

Section 3: Massachusetts Avenue to Main Street (RWT/BRT)



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Option 2: Trail with Bus Rapid Transit
Section 3: Massachusetts Avenue to Main Street

Section 3: Massachusetts Avenue to Main Street

EXISTING CONDITIONS SUMMARY

The track runs in a narrow corridor, with fences on either side. Along the east side, the chain link fence is generally 4-feet high, separating the track from an unpaved access road. On the west side, the fence varies in height from 4-feet to 8-feet.

A new MIT building, the Brain and Cognitive Sciences building, at Main Street between Albany St. and Vassar St., was recently constructed, and was designed to accommodate the BRT and a trail.

Paralleling the right-of way are Vassar Street (east) and Albany Street (west). There is a pedestrian crossing located between Massachusetts Avenue and Main Street.

The crossings in this section include a warning sign noting the presence of an AT&T transcontinental communications line running in the right-of-way.

This segment is entirely surrounded by MIT-owned land. Included are office buildings, a co-generation plant, a garage, and open parking lots.

The railroad crosses Massachusetts Avenue in close proximity to the Vassar Street and Albany Street intersections. Both intersections are signalized and have concurrent pedestrian phasing. Massachusetts Avenue is the busiest street crossing in the Grand Junction corridor. It has two travel lanes and a parallel parking lane in each direction. Bicycle lanes are being added as part of the Massachusetts Avenue reconstruction project.

North of Massachusetts Avenue, the Grand Junction line has a single track in the corridor.

OWNERSHIP

The right-of-way is MIT-owned in this segment, with a 20-foot easement granted to CSX for railroad operations.

UTILITIES

See Segment 2.

Massachusetts Avenue Grade Crossing: Looking northwest from Vassar Street

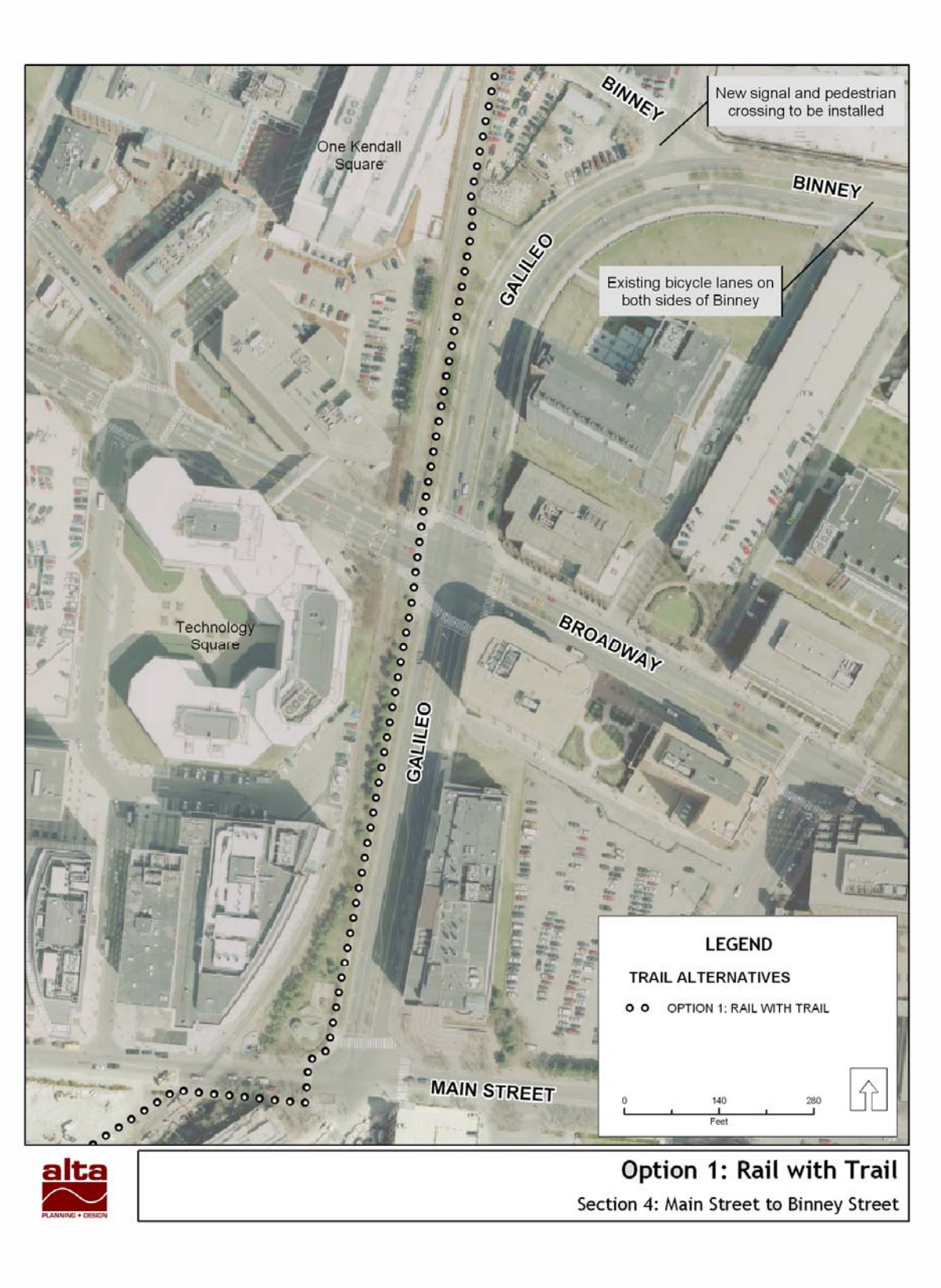
Looking north: MIT Power Plant on the right with large nitrogen tank

Signalized and gated pedestrian crossing of railroad south of MIT building 44

Section 3: Massachusetts Avenue to Main Street

OPTION 1: RWT	**OPTION 2: RWT/BRT**
Description	Description
The path would be located on the west side of the Grand Junction railroad main line for this entire section. The path would be set back from buildings on the west side of the corridor by varying distances.	The path would be located on the west side of the Grand Junction corridor.
Setback Distance	Setback Distance
20 feet from the edge of the path to the railroad centerline.	Dependent on the relocation of the CSX siding (and possible main line) in this section. With relocation, the setback would be approximately 30-40 feet from railroad centerline.
Key Issues	Key Issues
The new MIT Brain & Cognitive Sciences Center was designed to provide space for the trail on the west side of the corridor. Working with MIT as the sole land and rail corridor right of way owner will be a key aspect of the success of the Grand Junction Trail. From the path intersection at Main Street, users would have to use the existing sidewalk to the existing signal at Main St/Vassar St./Galileo Way.	The new MIT Brain & Cognitive Sciences Center was designed to provide space for the trail on the west side of the corridor. Working with MIT as the sole land and rail corridor right of way owner will be a key aspect of the success of the Grand Junction Trail. Potential conflicts between path users and of the service corridor located in this section behind the MIT Power Plant. Potential difficulties in meeting ADA requirements due to the slope of the corridor at certain points in this section.

Section 4: Main Street to Binney Street



Section 4: Main Street to Binney Street

EXISTING CONDITIONS SUMMARY

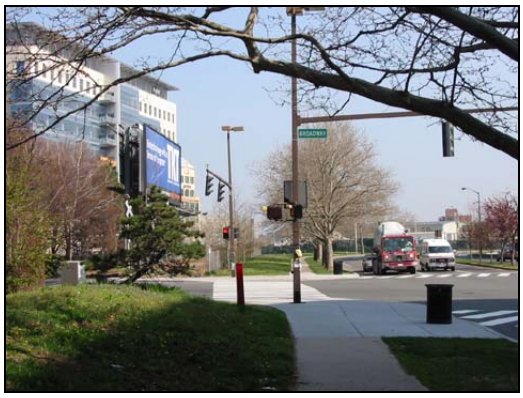
The section between Main Street and Broadway is very similar to the Massachusetts Avenue to Main Street segment. The track is situated in a narrow corridor defined by chain link fencing on either side. The trail is outside the rail corridor through this section.

To the west of this section is Technology Square, and office/R&D development that includes Draper Labs. To the east is a narrow strip between the Western Connector and the track which is owned by the Cambridge Redevelopment Authority. The strip is landscaped and features a mound or berm, planted with evergreen trees and grass.

From Broadway to Binney Street, the space between the fences is significantly wider. Chain link fencing lines each side of this segment of the right-of-way.

North of Broadway is "One Kendall Square," a mixed used development of office, R&D, and retail in renovated industrial buildings. To the east, the landscaped strip continues. Just north of the crossing at Broadway is a large billboard within the right-of-way.

This section also includes an AT&T transcontinental communications line running in the right-of-way. In addition, there is a Commonwealth Energy Corp. steam line running along the landscaped strip from Albany Street to Binney Street.



Looking north at crossing of Broadway

OWNERSHIP

For Option 1, the trail is shown on the south side of the rail corridor on land owned by the Cambridge Redevelopment Authority (CRA).

UTILITIES

Along the section of the pathway between Main Street and Broadway are several utility structures (steam vaults, electric manholes and traffic handholes) located within the grass area between the railroad tracks and the sidewalk. The grassy area is higher than the existing sidewalk in this area. Lowering the pathway to meet the existing grade of the sidewalk may require modifications to the utility structures. Other impacts may include traffic signal/street light conduit. Typically this conduit is installed at shallow depths. Construction of the pathway will require protection and/or relocation of these conduits.

The pathway between Broadway and Binney Street appears to run over an existing 30-inch storm drain and a 16-inch water main. It does not appear that the path will affect these utilities in this location.

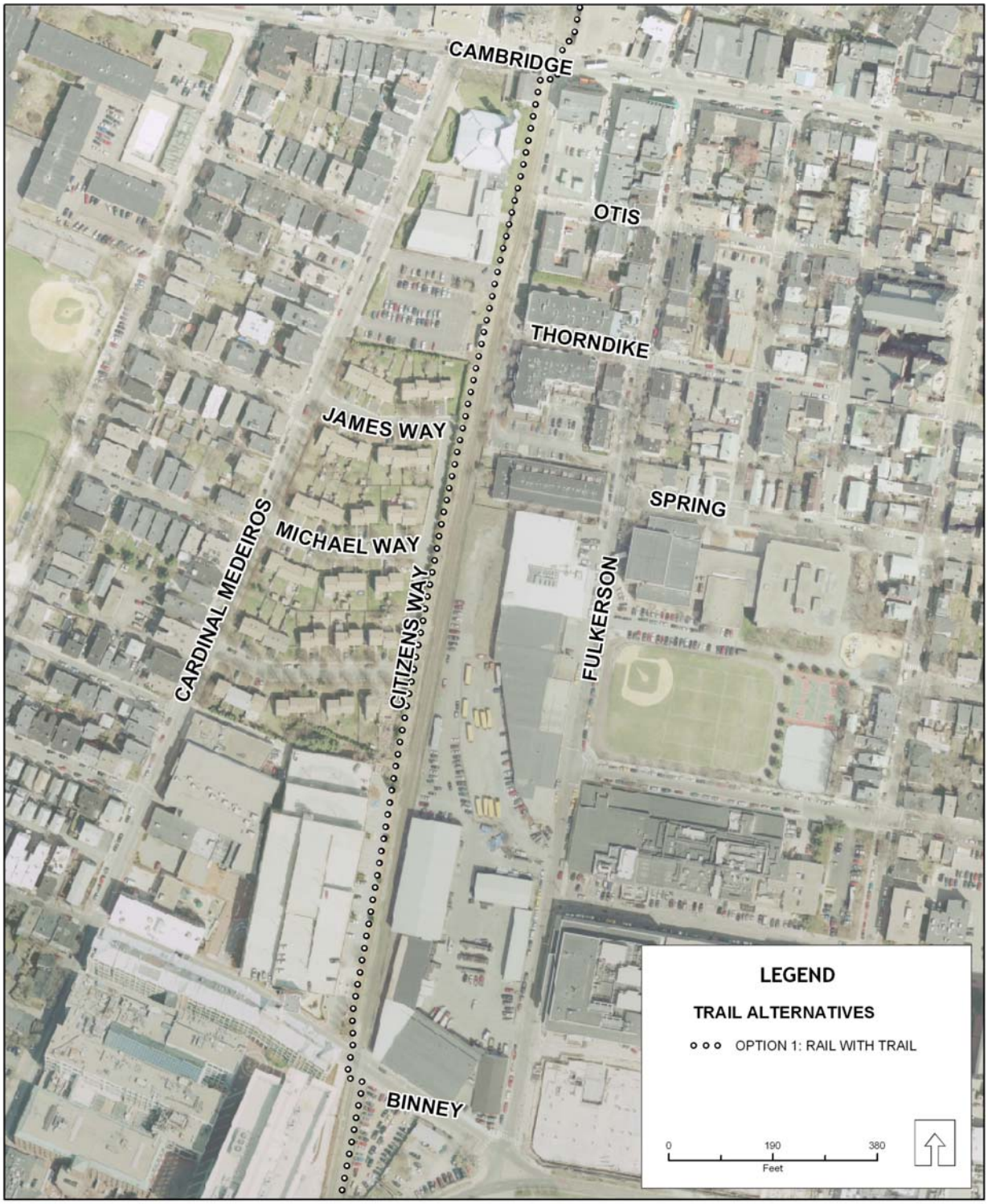
A steam vault abuts an electric manhole in this section that could present a potential conflict. The top of the electric manhole steps down to a depth of approximately 18 inches below the top of the steam vault. It appears that this structure will need to be modified or rebuilt during construction of the project. The extent of the modifications should be investigated during the design phase of the project.

Looking north from Broadway

Section 4: Main Street to Binney Street

OPTION 1: RWT	OPTION 2: RWT/BRT
Description	Description
At Main Street, the shared use path would turn east on a wider sidewalk to the Vassar Street intersection. This requires the path to cross the railroad tracks at this point. The path would be at least 10 feet wide and separated from the travel way on Main Street by a verge 3 to 5 feet wide. The path would cross Main Street in the existing sidewalk on the west side of the Vassar Street intersection. Between Main Street and Broadway, the shared use path would be constructed on land owned by the Cambridge Redevelopment Authority (CRA). The path would be built as a separate path to the west of the existing sidewalk. The existing sidewalk is separated from the travel way by an 8.4 foot landscaped strip. The path would continue on the east side of the railroad from Broadway to Binney Street on land owned by the CRA.	There is no BRT for the rest of the corridor, so there is only one alignment option.
Setback Distance	Setback Distance
20 feet from the edge of the path to the railroad tracks centerline.	N/A
Key Issues	Key Issues
Creating a safe crossing of the Grand Junction railroad tracks at Main Street. The future use of the CRA property from Main Street to Binney Street that is currently in the planning process. Working with the CRA to locate and maintain the path.	N/A

Section 5: Binney Street to Cambridge Street



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Option 1: Rail with Trail
Section 5: Binney Street to Cambridge Street

Section 5: Binney Street to Cambridge Street

EXISTING CONDITIONS SUMMARY

This section includes the greatest variety of land uses along the corridor. The Kendall Square cinema and a large public garage are located immediately north of Binney Street on the west side of the tracks. North of this site is a residential neighborhood of semi-attached homes. On the east side of the right-of-way are industrial uses on Fulkerson Street, such as the Metropolitan Pipe Company. Near James Way, these industrial uses are mixed with condominiums.

To the west are mostly single and multi-family houses on 2500-square foot lots. Based on the property maps, it appears that each original parcel has acquired an adjacent sliver parcel of what was once the right-of-way. These sliver parcels have become extensions of the various back yards with some including small structures (e.g., garages). This side of the right-of-way is fenced with chain link, typically 4 to 6 feet high.

The length of the right-of-way is fenced, typically with chain link of various heights. Near the development of semi-attached homes, there is a second wooden fence, which supplies screening.

OWNERSHIP

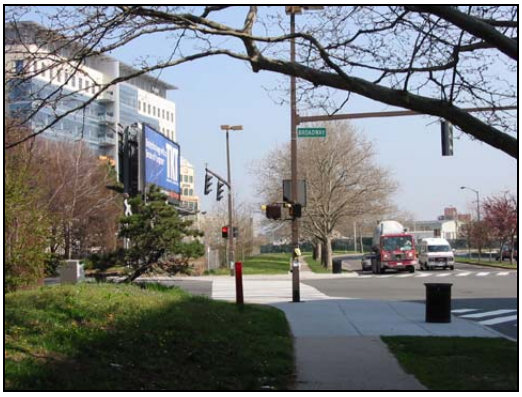
Along either side of the right-of-way, the assessor's maps indicate sliver parcels – evidence of land sold off by the railroad to abutters. The remaining railroad right-of-way is railroad-owned.

UTILITIES

For segments 5 & 6: Impacts to existing utilities appear to be minimal.

Any redesign of the parking lot at One Kendall Square to better accommodate the trail would require the relocation of existing area drains within the parking lot.

An 8-inch water main runs under the pathway for approximately 400 feet in this section. The water main, however, would not appear to have an impact on construction of the pathway.



One Kendall Square parking garage along Grand Junction corridor (looking north)

Looking north from Binney Street

Land on the west side of the railroad owned by Linden Park Homes

Section 5: Binney Street to Cambridge Street

OPTION 1: RWT	**OPTION 1A: RWT**
Description	Description
The shared use path is shown on the west side of the railroad between Binney Street and Cambridge. The path would be located on narrow slivers of property that were formerly part of the railroad corridor but apparently sold to abutters. For the most part, these slivers are undeveloped and could be used for a path without disrupting the adjoining land use.	Another option would be to locate the path on the east side of the railroad between Binney Street and James Way.
Setback Distance	Setback Distance
20 feet from the edge of path to track centerline.	12-20 feet from the edge of path to track centerline
Key Issues	Key Issues
Locating the path on the west side of the Grand Junction tracks requires an additional track crossing to be located at the Binney Street intersection. Acquiring the property or the rights to the right-of-way from the abutting properties in this section. Some redesign of the parking aisle on former railroad land would be necessary at One Kendall Square to maintain the 20-foot setback. Another option would be to decrease the trail setback from the railroad at this point. The path may have an impact on the parcel occupied by a Hair and Nail Salon on Cambridge Street. The path could possibly be moved closer to the railroad at this location or the building could be moved. Other options here include moving the railroad tracks and narrowing the path. More information is available in Appendix C.	The trail would be on the east side of the railroad from Binney Street to Cambridge Street. There are advantages to trail users in not switching sides of the tracks at both Binney Street and Cambridge. To maintain a 20-foot separation from the railroad tracks centerline, the tracks would need to be moved to the west after the Binney Street crossing, and a building addition within the Metropolitan Pipe & Supply Company complex would need to be removed. Further northeast, the path would encroach on an alley/drive for a series of multifamily residential buildings. This encroachment is significant and could render the residential parking inaccessible. At Cambridge Street the trail offset would again drop to 12 feet. More information is available in the Appendix C.

Section 6: Cambridge Street to Gore Street

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Option 1: Rail with Trail
Section 6: Cambridge to Gore Street

Section 6: Cambridge Street to Gore Street

EXISTING CONDITIONS SUMMARY

North of James Way, and extending to Cambridge Street, are the facilities of St. Anthony's Parish, including the church, parish hall, and related buildings. At Cambridge Street, there are two small mixed use properties.

North of Cambridge Street, the adjacent land uses are mostly residential. To the east is the block-long Millers River Apartment complex. Near Cambridge Street, the complex's recreation room is adjacent to the right-of-way. North of this, the apartment building itself is set back from the right-of-way, with a masonry wall along the right-of-way. There is a row of trees and shrubs planted on the track side of the wall, apparently within the right-of-way itself. At Cambridge Street, there is also a landscaped planter area that also appears to be within the right-of-way, based on the property maps.

To the west are mostly single and multi-family houses on 2500-square foot lots. Based on the property maps, it appears that each original parcel has acquired an adjacent sliver parcel of what was once the right-of-way. These sliver parcels have become extensions of the various back yards with some including small structures (e.g., garages). This side of the right-of-way is fenced with chain link, typically 4 to 6 feet high.

North of Cambridge Street, the area west of the tracks is predominately multi-family residential uses, with some undeveloped lots.

OWNERSHIP

Along either side of the right-of-way, the assessor's maps indicate sliver parcels – evidence of land sold off by the railroad to abutters. The remaining railroad right-of-way is owned by CSX and the Cambridge Housing Authority.

UTILITIES

See Segment 5.

Looking north towards Gore Street (Cambridge Housing Authority on right)

Gore Street crossing looking towards industrial area in Somerville

Cambridge Street, with Millers River Apartments at right

Section 6: Cambridge Street to Gore Street

OPTION 1	**OPTION 2**
Description	Description
From Cambridge Street to Gore Street, the path would be located on the east side of the railroad.	N/A
Setback Distance	Setback Distance
20 feet from path to the railroad centerline	N/A
Key Issues	Key Issues
The path may impact a parcel occupied by a Hair and Nail Salon on Cambridge Street. The path could possibly be moved closer to the railroad or the building could be redeveloped or razed. Other options include moving the railroad tracks and narrowing the path. There is no separated trail continuing north of Gore Street at this point in time. A direct connection to the Somerville Community Path would be complicated and require a specialized study. Grand Junction Trail users can use on-street connections to North Point via Cambridge Street or Gore Street. Directional signage would be appropriate.	N/A

On-Road Options for Traveling in the Grand Junction Corridor

When a major facility project is envisioned, the primary focus of analysis is to identify the value and benefits the facility can offer. It can also be useful to examine the question of what people will be likely or able to do without the facility in place. This is often called the "No-Build Alternative."

In the case of the Grand Junction path, the answer to what people do now or will be likely to do in the future without it may be somewhat different depending on whether they are taking a recreational trip or a transportation trip. They would also be different depending on whether they are going by foot or by bicycle, or whether they are traveling alone, or with small children. Many factors would contribute to these decisions; discussed here is a brief review of some primary ones.

For recreational users, the lack of a facility within a short distance of one's home can mean that the trip is simply not made. Encouraging physical activity is a major national as well as municipal goal, and it is important to create additional options for recreational opportunities are constantly whenever possible. Another option is that people may choose to drive to a recreational opportunity. This would be unfortunate, as it is a major transportation goal to reduce vehicular trips wherever practicable.

For those who might potentially be using the path as a connector and coming from longer distances, a significant break in the network can be a deterrent for making the trip, or can inhibit longer trips.

For those who would be using the path as an attractive transportation link, there is no single route to travel using city streets that would meet the exact desire line, and what people would do is highly dependent on the mode of travel, the ease of the trip, and the directness of the route.

There are also differences for those making walking trips and those making bicycling trips. For most people walking, the choices are fairly extensive, as virtually all streets in Cambridge have sidewalks. Greater constraints exist for trips made by bicycle. There is a fundamental difference between taking a trip on an off-road facility and riding on the road. Some people are looking for a trip that is primarily using off-road facilities, with little on-street travel, so will only take a trip by bicycle if a path is nearby. For those who are choosing to bicycle using on-street facilities, determining an individual route will depend upon a variety of factors, including the specific destination, the directness of the route, and the comfort level for traveling on that route. If one looks at the map using a presumed origin and destination from one end of the Grand Junction to the other, there is no one obvious route for cyclists to take. The map on the following page shows the street network and existing and planned bicycle facilities in Cambridge.

Another important factor to think about is who is using the facilities. An adult may feel comfortable riding on the street him/herself, for example, but would not do so together with children. Even the street/sidewalk network creates limits where children are concerned. Parents may be able to feel comfortable allowing children to take a walk by themselves on an off-road path, whereas they would not for children traveling along larger, more trafficked streets.

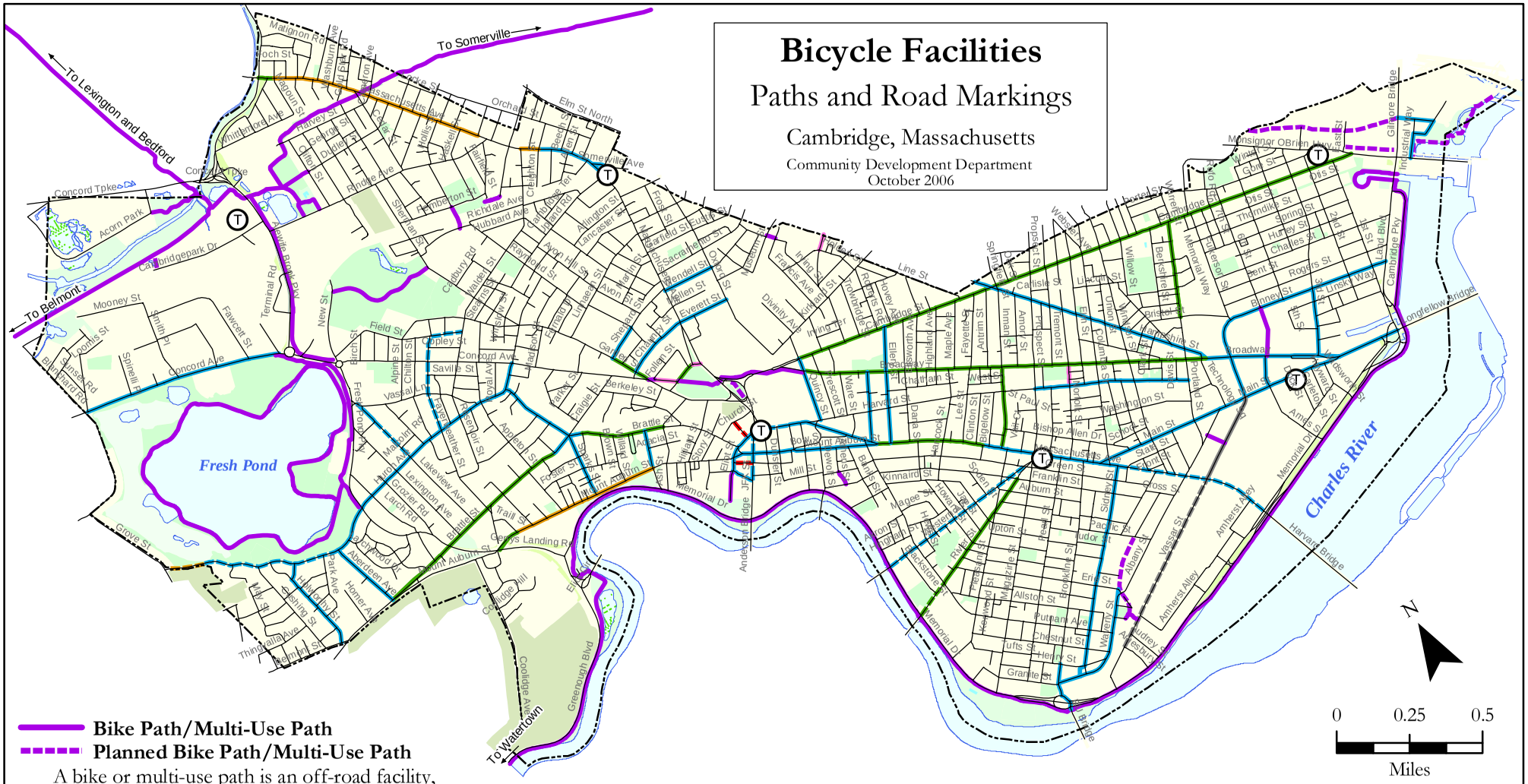
Conclusion: A Grand Junction trail would offer opportunities that don't currently exist, both in terms of route choice and connectivity and in terms of type of facility that makes the choices of bicycling and walking more available to a larger group of users.

Bicycle Facilities

Paths and Road Markings

Cambridge, Massachusetts

Community Development Department
October 2006



Bike Path/Multi-Use Path
Planned Bike Path/Multi-Use Path

A bike or multi-use path is an off-road facility, physically separated from motor vehicle traffic by an open space or barrier. Most paths are used by many forms of non-motorized travel (e.g., walking, skating, and jogging) in addition to bicycling.

Bike Lane
Planned Bike Lane

A lane on a street restricted to bicycles and designated by means of painted lines, pavement coloring, bicycle symbols, or other appropriate markings.

Contra-flow

A contra-flow lane is a bicycle facility marked to allow bicyclists to travel against the flow of traffic on a one-way street.

Cycle Track
Planned Cycle Track

Grade-separated bicycle lanes, usually located between the street and the sidewalk.

Shared Lane Pavement Marking
Planned Shared Lane Pavement Marking

A bicycle symbol marked on the pavement intended to remind motorists that bicyclists share the road. Used when there is insufficient space for bicycle lanes and specific bicycle markings are desired.

Edge Line
Planned Edge Line

Also known as guide lines or fog lines, these are stripes at the inside edge of the travel lane closest to the curb. When there is insufficient space for a bicycle lane, an edge line is sometimes installed to create space between the travel lane and parked cars.

Planned Shared Street

A street that is created as a common space to be shared by pedestrians, bicyclists, and low speed motor vehicles, all at the same level without grade-separated sidewalks.

For an 11" x 17" version of this map, go to http://www.cambridgema.gov/cdd/et/bike/bike_map.pdf

Map prepared by Brendan Monroe on October 11, 2006. CDD GIS d:\Projects\BikePaths\Facilities8x11.mxd

Potential Impacts on Utilities

The consultant team collected utility information from existing documents and field review. In the discussion of the segments below, the trail was assumed to be laid out per Option 1, which was used to illustrate the locations of utility impacts relative to the proposed trail route. The excavation required for the installation of sub-grade for the trail should be quite shallow (18 to 24 inches). Excavations to these depths should not be in conflict with any existing utilities within the pathway. However, changes to the existing grades along the pathway due to ADA requirements or drainage issues may create conflicts with existing utilities. The grading design for the pathway will need to be coordinated with the subsurface utility information to ensure that a sufficient amount of ground cover is maintained over all existing utilities.

The proposed stormwater collection system for the pathway could produce some conflicts with the existing utilities. The method for collecting stormwater has yet to be determined. Possible methods include:

- Collection of runoff with catch basins/area drains with the discharge to the City of Cambridge's existing stormwater collection system,
- Collection of runoff with dry well catch basins that infiltrates runoff into the ground, and
- Collection of runoff with drainage swales located on one or both sides of the pathway that infiltrate into the ground through a bed of crushed stone and into a French drain system.

The path might be constructed with a minimum pitch to either side allowing for sheet runoff and collection of runoff in existing drainage systems within the railroad corridor.

Whichever method, or combination of methods, is chosen for collecting the stormwater, the design of the system(s) will need to take into account the various existing utilities located within, and immediately adjacent to, the pathway. The proposed stormwater collection system will require the approval of the City of Cambridge Department of Public Works.

Utility access structures located within or adjacent to the pathway will need to be accounted for during the design of the pathway. Some of the utility structures that may affect or be affected by construction include: steam vaults, electric manholes, telecommunications manholes, traffic and streetlight hand holes and water gate boxes. Changes to the existing grades for the construction of the pathway will require the adjustment of frames and covers and possibly the modification or relocation of the existing structures. Any modifications or relocations of utility structures could be costly and impact the schedule of construction significantly. The design of the pathway should consider any of the potential impacts to major utility structures, and coordination with the appropriate utility companies is essential.

Utility owners will require maintenance or emergency access to utility structures that may restrict, or obstruct completely, access to the pathway. It may be necessary to provide a temporary bypass or widen the pathway in certain locations so that travelers on the pathway may still use the pathway during these circumstances.

Environmental Analysis

Based on a desktop review of readily available environmental records, Polyaromatic Hydrocarbons (PAHs), Petroleum Hydrocarbons, and metals are likely present in the surface soils along the proposed route of the bike path. Appendix E contains figures and a table summarizing several environmental sites that are in the vicinity of the proposed trail route.

Many of the reports reviewed contained information from local file reviews including City of Cambridge Fire Department and the Cambridge Historical Commission. SEA interviewed MIT personnel in the course of preparing several of the Phase I reports.

One significant report prepared by SEA is entitled "MIT Utility Design and Construction Oil and Hazardous Materials Investigation", dated September 22, 1999. This report contains detailed information about surrounding listed DEP sites, as well as analytical data for all of SEA's subsurface investigations along the CSX Railway and Vassar St. A total of 40 borings were completed along the CSX Railway and Vassar St. between the intersections of Amesbury St. and Vassar St. to the intersection of Main St. and Vassar St.

Based upon information gathered from completed field investigations, analytical results, and records review, the following observations apply:

- Reportable Concentrations of PAHs, Petroleum Hydrocarbons, or Metals under 310 CMR 40.000 are likely present in the soils at many of the sites within the route and within close proximity to the proposed trail.
- Evidence of subsurface contamination from both known and unknown sources of oil and hazardous materials was observed or detected in the soil and groundwater samples collected by S E A as specified in the report "MIT Utility Design and Construction Oil and Hazardous Materials Investigation", prepared by S E A.
- Due to the strong likelihood of the presence of contaminants, pre-characterization of the soils within the proposed trail should be performed primarily to assess the risk to construction workers, and to verify the presence and concentrations of contaminants. The number of pre-characterization samples necessary would be approximately 20 samples assuming a total trail length of 10,000 feet (1 sample/500 feet). The samples should be tested for arsenic, lead, and extractable petroleum hydrocarbons with target analytes.
- The presence of contaminants in the soil could pose a hazard to both the construction workers and the public welfare during trail construction. The main route of entry of contaminants would be through inhalation (air intake vents on buildings near the proposed bike path, construction workers exposed to dusts, etc.).
- A site-specific Health and Safety Plan (HASP) should be developed based on pre-characterization data to minimize the hazards to construction workers and the public during trail construction.
- Construction methods should be specified to minimize handling soils, to minimize the creation of an excess volume of soils, and to minimize the exposure of soils to construction workers and the public. Possible construction methods would include:

    1. Wetting soils with water prior to excavation to minimize generating dust;

2. Utilizing excess soils underneath the proposed bike path to the maximum extent possible by raising the final grade of the pathway;

3. Spreading soils with acceptable contaminant levels along the sides of the proposed bike path;

4. Mixing existing soils with structurally supportive soils to make the soils geotechnically suitable for reuse as a base for the proposed bike path to minimize excavation and removal;

5. Stabilizing either side of the proposed bike path with packed stone dust to minimize the public's future contact with the soil;

6. Installing fencing between the existing railroad rails and the proposed bike path to maximize safety of trail users from the railway and to minimize exposure of trail users to surface soils on the railway; and

7. Using landscaping techniques to cover the soils near the proposed bike path, thus limiting the exposure to the public.

- A modest amount of excess soils will likely be generated requiring proper disposal. Any soil destined for disposal must be sampled for full disposal characterization analytical data. It is usually required to characterize each 500 yd^3 of soil for disposal. The concentrations of contaminants in the soil will dictate the method and location for disposal. Approximate costs for disposal of different soils are listed below:
- The quantity of material disposed will determine the number of samples requiring full disposal characterization at a maximum of 500 yd^3 per sample. Assuming a modest amount of excess soils would be generated, the most cost-effective method would be to stockpile the excess soils accordingly and sample the stockpile for full characterization. The volume of the soil stockpile will dictate the number of samples needed (i.e., 300 yd^3 would require 1 full characterization sample; 600 yd3 would require 2 full characterization samples).

Intersections

The Grand Junction Railroad has six at-grade roadway crossings (Massachusetts Avenue, Main Street, Broadway, Binney Street, Cambridge Street, and Gore Street) within the City of Cambridge in addition to the grade-separated crossing at Memorial Drive. The crossings are relatively closely spaced and motorists within this urban area currently experience frequent and significant pedestrian activity. These factors reduce the typical concern over the unexpectedness of a pedestrian crossing at existing railroad/roadway grade crossings in the Grand Junction corridor. However, sufficient warning signage must be included at each crossing location to alert motorists and pedestrians to the crossing locations and regulations.

The proposed grade crossings along the Grand Junction corridor are summarized in Table 3-1, with design recommendations in Chapter 4.

Table 3-1. Roadway Crossing Recommendations

Roadway	# of Lanes	Width (ft)	PM Peak Hour Volume*	Recommendation
Massachusetts Avenue	4	62	2,050	New Signalized Crossing
Main Street	2	48	1,050	Routed to Existing Signal
Broadway	4	62	1,700	Routed to Existing Signal
Binney Street	2	32	500	Uncontrolled Crossing
Cambridge Street	2	52	1,300	Combine with existing Miller's River Apartment crossing
Gore Street	2	37	1,100	Uncontrolled Crossing

* PM peak hour volumes obtained from the MBTA's Urban Ring Study and the City of Cambridge (2003)